X69-71323

BELLCOMM, INC.
955 L'ENFANT PLAZA NORTH, S.W. WASHINGTON, D. C. 20024

SUBJECT: Operational Intercommunication System Monitoring at KSC During Apollo 7 CDDT Case 900

DATE: September 25, 1968

FROM: B. F. O'Brien

ABSTRACT

The performance of the Operational Intercommunication System was monitored at KSC and MCC during the Apollo 7 CDDT.

This memorandum provides a summary of the observations made at KSC during the test. In general, the quality of the voice circuits was very good. A low level of crosstalk prevailed, but it was not considered objectionable. There were, however, several instances of loud or annoying crosstalk. Measurements were made with a VU meter to determine the range of talker levels, the amount of background noise and the amount of crosstalk as heard at a typical OIS station.

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MEMORANDUM FOR FILE

1.0 Introduction

The Operational Intercommunication System (OIS) was monitored during the Apollo 7 Countdown Demonstration Test (CDDT) by representatives of MAS/Bellcomm, and MOG. A major portion of the monitoring was done at the Blockhouse, Room 107, on Launch Complex 37 where several of the 4-wire circuits from LC 34 appear. The system was observed from 1800 Z September 15, to 2400 Z September 16, during the Wet CDDT, and from 1330 Z September 17 to 2100 Z September 17 during the Dry CDDT. Observations were also made at CDSC, CIF, MSOB, MILA, MCC at MSC.

Periodic measurements were made at the LC 37 OIS station to determine quantitatively the relative background noise, speaker levels, and crosstalk levels. Figure 1 is a diagram of the test configuration. It will be observed that the meter reading, in VU's, is dependent upon the setting of the OIS volume control. The setting was approximately 2/3 full scale, and was maintained at this point throughout the test. The output of the two monitoring channels was determined to be approximately the same, for the same volume control setting. In addition, it was observed that the difference in output between full scale and the setting used was approximately 5 db.

The OIS channels available for monitoring at the Blockhouse were Black 1 through 6, Red 3 through 6, Blue 1 through 4, Green 1, 3, and 5, and Brown 1.

2.0 General Observations

2.1 Summary

Although there were isolated trouble conditions, the OIS system performed well, and is considered operationally usable.

2.2 Talker Levels

With the volume control adjusted for a comfortable sound level, the VU meter indicated approximately -15VU for the average talker. For weak talkers, the voice level dropped to -25VU, and in extreme cases to less than -30VU. It was also observed that the same talker on the same channel would not always be heard at the same level, probably because of their microphone position.

Certain off-KSC users were consistently recorded approximately 10 db higher than other users on a given channel. This was noted on more than one channel, indicating that it was a general situation, and not the cause of a single amplifier in the OIS system being set too high. The off-KSC users were GMIL at the MILA Unified S-band site, SRO at the Eastern Test Range, and Houston Flight at Houston.

2.3 Background Noise

The noise on each channel was measured while there was no voice or crosstalk present. The volume ranged from -60VU for the quietest, to -41VU for the noisiest. While the range of 20 db appears considerable, it was noted that the noise at -41VU was not necessarily objectionable. The amount of annoyance or interference caused by noise depended more upon the type of noise rather than by its level.

As heard at LC 37, Black 1 was considered the noisiest channel and had the most objectionable noise. Its noise level was approximately -41VU, with a noise that sounded like a running motor. On the other hand, Black 4 and Black 6 consistently had noise levels of approximately -42VU, but they were considered much more acceptable than Black 1. The noise on these channels was more like a hissing or rushing of air. Red 5 had a noise level of -60VU, but it was considered more annoying than the noise on more other channels because the sound was a low frequency buzz.

2.4 Crosstalk

Crosstalk was observed on most channels, but it was generally 25 db and 45 db below the average talker level (-15VU). The higher values of crosstalk occurred on those channels with higher noise levels, since the crosstalk was superimposed on the background noise. The VU meter therefore indicated the summation of noise plus crosstalk.

Low level crosstalk, which was only a minor annoyance, was present almost continuously through the tests. There were incidents of high level crosstalk which were annoying to the users and which were commented on or reported as trouble conditions. The level of crosstalk tended to buildup somewhat on a few channels near T=0 when most users were monitoring the same channel, ie. Black 2.

The effects of a high background noise adding to the crosstalk were more noticeable at the MSOB where the OIS-RF system is used. This system is equipped with a squelch circuit in each OIS station to render the background noise inaudible. With a noisy channel such as Black 1, the crosstalk was sufficient to raise the total noise-plus-crosstalk above the level at which squelch is broken. The result was short bursts of noise and crosstalk which is generally considered more annoying to a user than a constant background noise.

Although the range of measurements of noise-plus-crosstalk was from -39VU to -58VU, the crosstalk heard at the higher levels was not necessarily more annoying than that at the lower levels. This was attributed to the masking effect of the noise. The factor which appeared more significant was the difference between the values of noise, and noise-plus-crosstalk.

Some incidents of crosstalk were attributed to open microphones, particularly in cases where a speaker was in use near a talker. Fortunately, the number of occurrences of this problem has been decreasing in recent tests as compared to earlier tests.

2.5 VHF Radio

Trouble was experienced with VHF down link voice transmission. Several users noted that the voice from the spacecraft was distorted and unintelligible at times. The distorted down link transmission was heard on the OIS system, and was noted by the MAS and MOG observers. The cause of the distortion has been attributed to the VHF receiver.

3.0 Specific Observations

The following observations are excerpts from the test log book to substantiate the foregoing discussion, and to point out the more troublesome events. Appendix 1 contains tabulated data pertaining to the measurements of noise, talker levels and crosstalk.

3.1 Wet CDDT

15 September 1968

2020Z The speech level on Blue 5 was -10VU. The resulting crosstalk on Black 1 from Blue 5 was -35VU (including noise).

2103Z A loud (-17VU) background noise on Black 5 was only 7 db below the talker level.

16 September 1968

0142Z Ringing tone and data sounds were being heard at the Astro-Comm Panel.

0342Z Open microphone on Blue 2.

1015Z Loud crosstalk reported between Black 5 and Black 6.

1550Z GMIL on Green 5 was at a -7VU level, compared to other users at -17VU.

1600Z GMIL, SRO and Flight were heard about 10 db higher than CVTS on Black 2.

1810Z No OIS service to the pad.

1940Z At MSOB, the crosstalk on Black 1 was heard breaking squelch on the OIS-RF system.

1944Z CVTS complained about crosstalk from Black 5 to Black 1. This was measured at the monitoring position at -35VU, approximately 6 db above background noise.

2000Z At the Fallback Area, Black 7 was reported being "blocked" by Black 1 when Black 1 was active.

3.2 Dry CDDT

17 September 1968

1306Z Flight complained about "telephone" crosstalk on Black 3. None heard by CVTS on Black 3.

1441Z Black 4 and Green 3 were bussed together.

1521Z A hissing noise slowly built up to a loud level and then disappeared.

1835Z Black 1 and Black 2 were bussed together.

1950Z Black 1 and Black 2 were bussed again. The voice heard on Black 1 was measured 10db lower than the same voice heard on Black 2, with some distortion.

1959Z Black 3 became unusable because of a loud noise.

J. P. Raleigh for B. F. O'Brien

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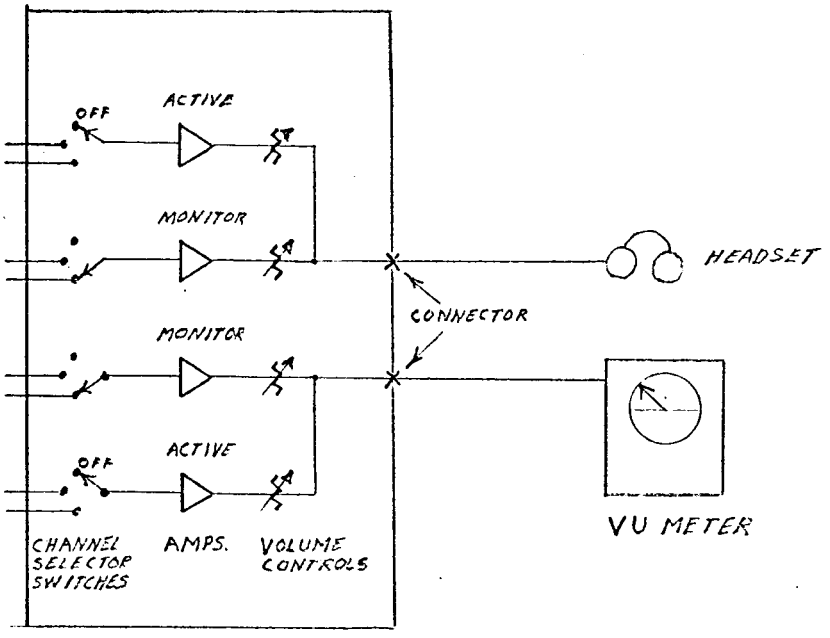

FIG 1

MONITORING AND MEASURING CONFIGURATION

APPENDIX I

TABULATION OF MEASUREMENTS MADE DURING THE CDDT

WET CORT

BACKGROUND NOISE ON IDLE CHANNELS - IN VU

	9-15-68*			9-16-68*								
TIME - Z	1900 Z	MISC	2300	1100	1215	1430	1550	1720	1810	1850	1945	2155	2250
BK1	-40			-41		-40	-41	-41		-41	-41		-41
BK2	-45			-48		-47	-47	-47	-47	-47	-47	-47	-47
BK3	-43				-46	-47	-43	-45.5	-46	-47	-46	-47	-45
BK4				-43	-43	-43	-35	-37	-37	-37	-37	-37	-37
BK5		-47			-58	-58	-60	-58	-60	-58	-58	-60	-60
BK6				-58	-53	-50	-48	-52	-66	-48	-47	-50	-50
RD3	-47				-47	-47	-45	-60	-60	-60	-60	-50	-48
RD4									-60	-60	-60	-60	-60
RD5	-60			-58	-58	-58	-60	-60	-60	-60	-60	-60	-60
RD6	-60			-55	-55	-55	-56	-57	-58	-60	-52	-60	-60
BL1	-60												
BL2	-50												
BL3			-47	-50	-50	-50	-44	-50	-46	-50	-50	-47	-48
BL4													
BL5				-60	-55	-55	-60	-60	-60	-60	-60		-60
GN1	-43			-45	-45	-45	-43	-44	-45	-45	-45	-45	-45
GN3	-43			-45	-45	-45	-43	-45	-45	-45	-45	-48	-47
GN5	-47			-50	-48	-49		-47	-49	-50	-50	-50	-49
BRV				-60		-60		-55	-53	-52	-60	-60	-60

* VOLUME CONTROL SETTING NOT THE SAME ON BOTH DAYS

TABLE 1

WET CDDT

CROSSTALK + NOISE ON IDLE CHANNELS - IN VU

	9-15-68 *			9-16-68 *								
TIME - E	1900	MISC	2300	1100	1215	1400	1550	1730	1815	1850	1945	2155	2250
BK1				-40	-41	-39		-40	-37	-40	-37	-37	
BK2		-45		-46	-47	-45		-42			-45	-43	
BK3			-34								-47		
BK4		-40											
BK5				-48			-47	-52	-48	-48		-55	
BK6		-40		-48	-48	-47		-45	-37	-40	-42	-47	-45
RD3		-40								-54			-47
RD4													
RD5													
RD6				-42	-47		-50	-47			-47	-47	-50
BL1													
BL2	-50												
BL3				-43		-45					-47		
BL4												-58	
BL5				-58		-47	-45	-55	-55	-58	-55		
GN1									-47				
GN3												-46	
GN5													
BR4				-55	-55	-55	-55			-50	-55	-50	

* VOLUME CONTROL SETTING NOT THE SAME ON BOTH DAYS

TABLE 2

WET CDDT
TALKER LEVELS - IN VU

TIME - Z	*9-15-68 1900	MISC	2300	*9-16-68 1100	1215	1400	1550	1730	1810	1850	1945	2155	2250
BK 1		-12	-24	-20	-17	-15,-20		-17	-17	-13,-20		-17	-25
BK 2		-10,-17	-26			-11			-15				
BK 3											-13		
BK 4	-10	-16	-12	-17									
BK 5	-12	-10	-15		-15		-15	-17	-13		-12,-17		-17
BK 6	-8,-11		-10	-13	-11			-12	-13	-13	-14	-15	
RD 3				-15,-25								-15	
RD 4													
RD 5													-15
RD 6							-25	-12	-15		-17		
BL 1													
BL 2													
BL 3	-10			-15,-20					-12,-17				
BL 4													
BL 5	-10	-25	-20,-30		-10	-11	-15					-10	
GN 1													
GN 3		-16		-12				-17	-11,-15				
GN 5					-8,-20	-8,-25	-17						
BR 4	-10			-10,-30					-25				

* VOLUME CONTROL SETTING NOT THE SAME ON BOTH DAYS

TABLE 3

DRY CDDT

BACKGROUND NOISE ON IDLE CHANNELS - IN VU

9-17-68

TIME - Z	1330	1430	1515	1600	1710	1730	1836	1930	2030
BK1	-41	-41	-41	-42	-41	-41	-41	-41	-42
BK2	-47	-48	-47	-47	-47	-47	-47	-46	-46
BK3	-47	-45	-45		-43	-45	-45	-43	-46
BK4	-36	-42	-43	-43	-41	-43	-43	-43	-37
BK5	-55	-58	-58	-58	-58	-58	-58	-57	-58
BK6	-43	-43	-42	-43	-43	-42	-42	-42	-42
RD3	-56	-49	-48	-50	-47	-43	-50	-50	-50
RD4	-60								
RD5	-58	-58	-60	-60	-60	-60	-60	-60	-58
RD6	-60	-60	-60	-60	-60	-60	-60	-60	-60
BL1	-60								
BL2	-60								
BL3	-49	-50	-50	-48	-47	-48	-50	-47	-52
BL4	-60								
BL5	-58	-58	-60	-60	-60	-60	-60	-60	-60
GN1	-44	-44	-42	-42	-42	-45	-45	-45	-45
GN3	-47	-45	-45	-45	-43	-45	-45	-45	-45
GN5	-48	-50	-49	-50	-47	-43	-50	-50	-50
BR4	-58	-60	-60	-60	-60	-60	-60	-60	-60

TABLE 4

DRY CDDT

CROSSTALK + BACKGROUND NOISE ON IDLE CHANNELS - IN VU

9-17-68

TIME - Z	1330	1430	1515	1600	1710	1730	1830	1930	2030
BK1			-40	-40	-37	-39			
BK2									
BK3			-44						
BK4		-42	-42			TONE -35	-41		
BK5					-49	-55	-46	-45	-48
BK6	-40						-40	-40	
RD3	-48			-48					-48
RD4									
RD5	-57								
RD6									
BL1									
BL2									
BL3							-43		
BL4			-46	-43					
BL5	-50			-58			-55		
GN1	-41								
GN3								-43	-42
GN5									
BR4	-57	-40	-58	-58	-50	-55	-55	-55	

TABLE 5

DRY CODT

TALKER LEVELS - AN VU

9-17-68

	1330	1430	1515	1600	1710	1730	1830	1930	2030
BK1					-17		-13		
BK2	-13,-17	-15,-20			-17,-25	-17	-15		
BK3			-13	-15	-15		-13		
BK4	-12	-12						-15	
BK5	-13,-17							-15	
BK6						-15			
RD3	-15	-15							
RD4									
RD5									
RD6									
BL1									
BL2									
BL3									
DL4									
BL5						-15			
GN1			-10,-35			-15			
GN3									
GN5	-10,-17	-10,-15							
BR4	-11,-15								

TABLE 6